2 / HUMANITY VS ENVIRONMENT

2.1 / IN THE BEGINNING

Since man's earliest recorded history there has been a need for protective shelter against the elements. According to Vitruvius, man started with temporary shelters of leaves and rocks, which imitated the nests of birds (Fletcher, 1961: 7). Around 8 000 BC, man's shelter evolved into a more permanent structure. Mud brick houses were constructed and signs of social gatherings were seen in the development of small towns of about 10 acres in size.

In 6 500 BC mud houses evolved into a more complete form. Small details show that humans shaped their houses in an increasingly intellectual manner to form improved livable space inside the house. Walls were shaped into seating and storage spaces, and entrances into houses were stepped up from the ground to keep water out. The materials extracted from the earth's surface were mud to make bricks for walls and stone to shape a corbeled dome for the roof (Gascoigne, n.d). The rounded shape remained the obvious form for a house; considering the tools of the era and the natural materials that could be gathered.

In the 4th Millennium BC an understanding of climate also started to affect building structures. Bundles of reeds were bound together and plastered with mud to create weatherproof shelters. In Egypt, sun-dried mud bricks were the building blocks of man's first monumental buildings. But around 2620 BC, Egyptians started to use stone, and later cut stone, to create pyramids. This in itself was a great innovation for that time (Gascoigne, n.d). Colossal temples in ancient Egypt, erected between 1500 – 1350 BC, were constructed with very large stones; these temples became an image of power and victory and was the start of a lasting tradition in architecture.

The first sign of cement as a structural material was found in Greek buildings from around 200 BC. The Greeks found that lime binds sand, water and clay. The Romans, however, used finely ground volcanic rock instead of clay, which helped in creating the great arches and aqueducts of Roman architecture. This cement of the Romans was the strongest mortar in history, until the development of Portland cement (Gascoigne, n.d). Roman architecture thrived as new technologies were created. The pivotal point in the rapid decline of natural resources was not reached until the age of industrialization, refer to figure 2.5.

2.1_ “The primitive hut” by Marc-Antoine Laugier. The primitive hut came from nature, rooted in functional and structural basis. (http://mellowmerriment.blogspot.co.za/2012/08/thesis-part-ii.html).

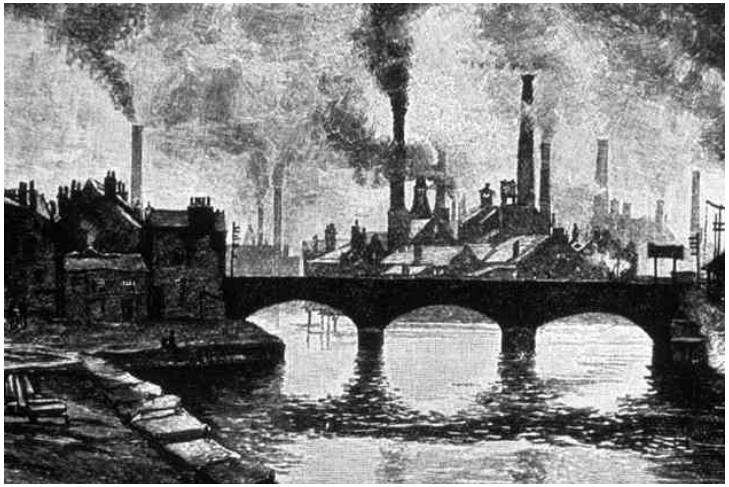
2.2_ A dipiction of the primitive hut in a tent form, with wood as the supporting structure with animal skin for covering. (http://25.media.tumblr.com/tumblr_m1b18bpWqY1qzlcoro1_400.jpg).

2.2 INDUSTRIALIZATION: IMPACTING THE ENVIRONMENT AND SOCIETY

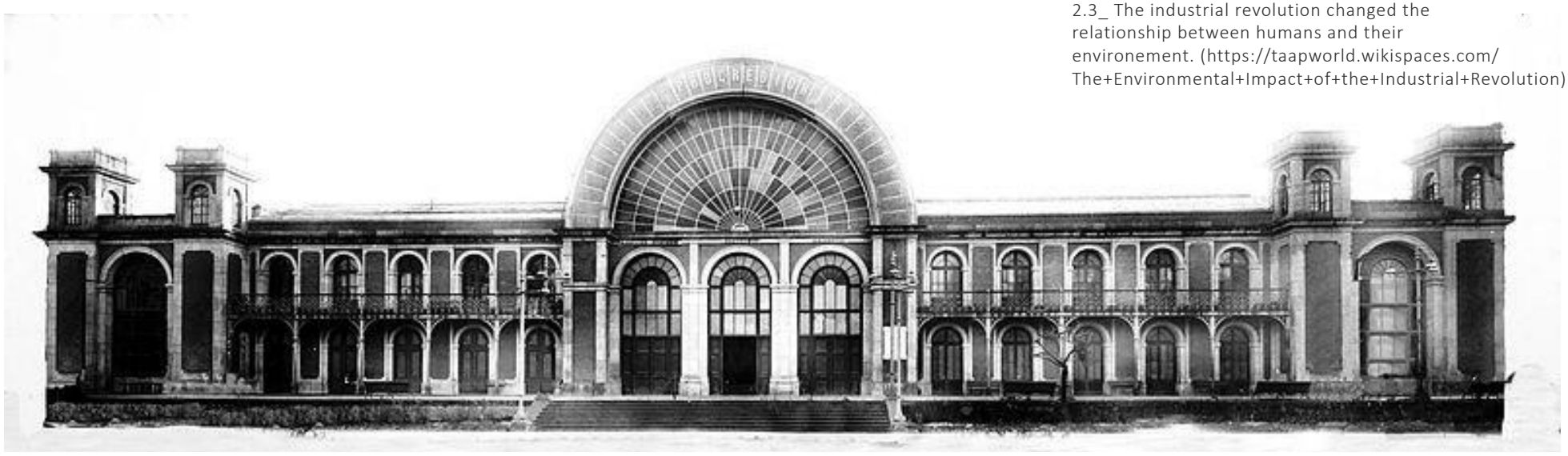
The industrial-era continues to play a significant role in the development of the built environment. The advancements of the time greatly influenced industries worldwide (Mang et al, 2012: 10). The first industrial revolution was significant as it entailed a shift from hand methods of production to machine production; with coal fueled factories being the norm from 1760 to 1840. The Crystal Palace was built in the 1850's and was seen as a technological wonder of the world and triumphed over fabricating materials in a continuing order (Sloterdijk, 2005: 12).
Starting in the 1860s, oil and other combustibles were also used as alternative fuels (Speight, 2011; 157). Industrialization in general generated tremendous increases in the productivity of industries and gave rise to economic growth and advances in transportation and trade, as well as city expansion and urbanization (boundless, 2015).

However, the human "need and greed" to expand cities in the best and quickest ways possible resulted in negative environmental and ecological outcomes. The primary source of energy for industries was the burning of coal. At the outset, the surface extraction technique was used, but as the industrial revolution progressed this changed to deep shaft mining. Deep shaft mining not only exhausts the natural resources available but also places enormous stress on the environment and ecological systems (Environment Insider, 2014). The constant burning of immense quantities of coal (to generate electricity) resulted in pollution. This pollution was a by-product of economic development in industries and seen as an unavoidable part of city life in general (Wiek et al, 2011: 1).
From the ashes of environmental pollution, a new recognition of the natural world arose. Transcendentalism as an intellectual movement emerged in the 1830s and 1840s (Boundless, 2015). Henry David Thoreau, one of the authors of transcendentalism, studied the philosophy of natural history and predicted two sources of modern day environmentalism, namely ecology and environmental history (Environment Insider, 2014).

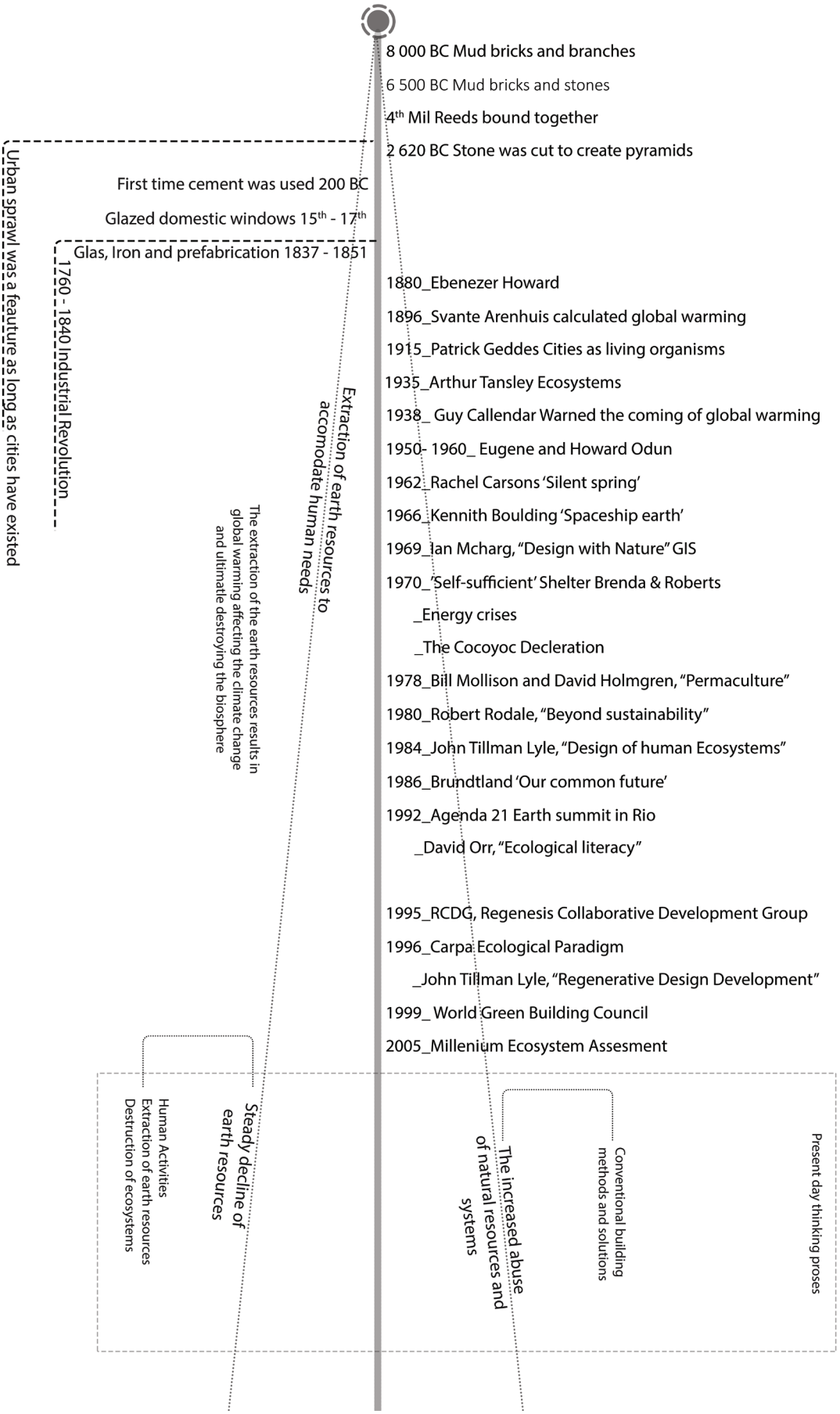
The world is facing ecological destruction at the hands of humanity. The media tends to blame government and corporations, diverting focus from the root problem: that humanity faces extensive environmental challenges (Westley et al, 2013: 1), (Wiek et al, 2011: 1). An example of one of the challenges we face is the destruction of habitats through deforestation allows for urban sprawl and causes water pollution, air pollution and climate change, all of which result in global warming. These environmental challenges impact natural resources, ecosystems and human health. Water and air pollution, spreading from rapidly growing cities and industries that developed in the industrial era, have dangerous effects on humans and the environment (Environment Insider, 2014). The Millennium Ecosystem Assessment presents growing evidence of the effects of global warming becoming visible much earlier than predicted, and that these effects are indeed accelerating climate change (Du Plessis, 2006: 5). It also finds that, because of climate change, almost two-thirds of crucial services that nature provides mankind are rapidly declining worldwide. In consequence, it can be said that we are living on borrowed time (Du Plessis, 2006: 5).

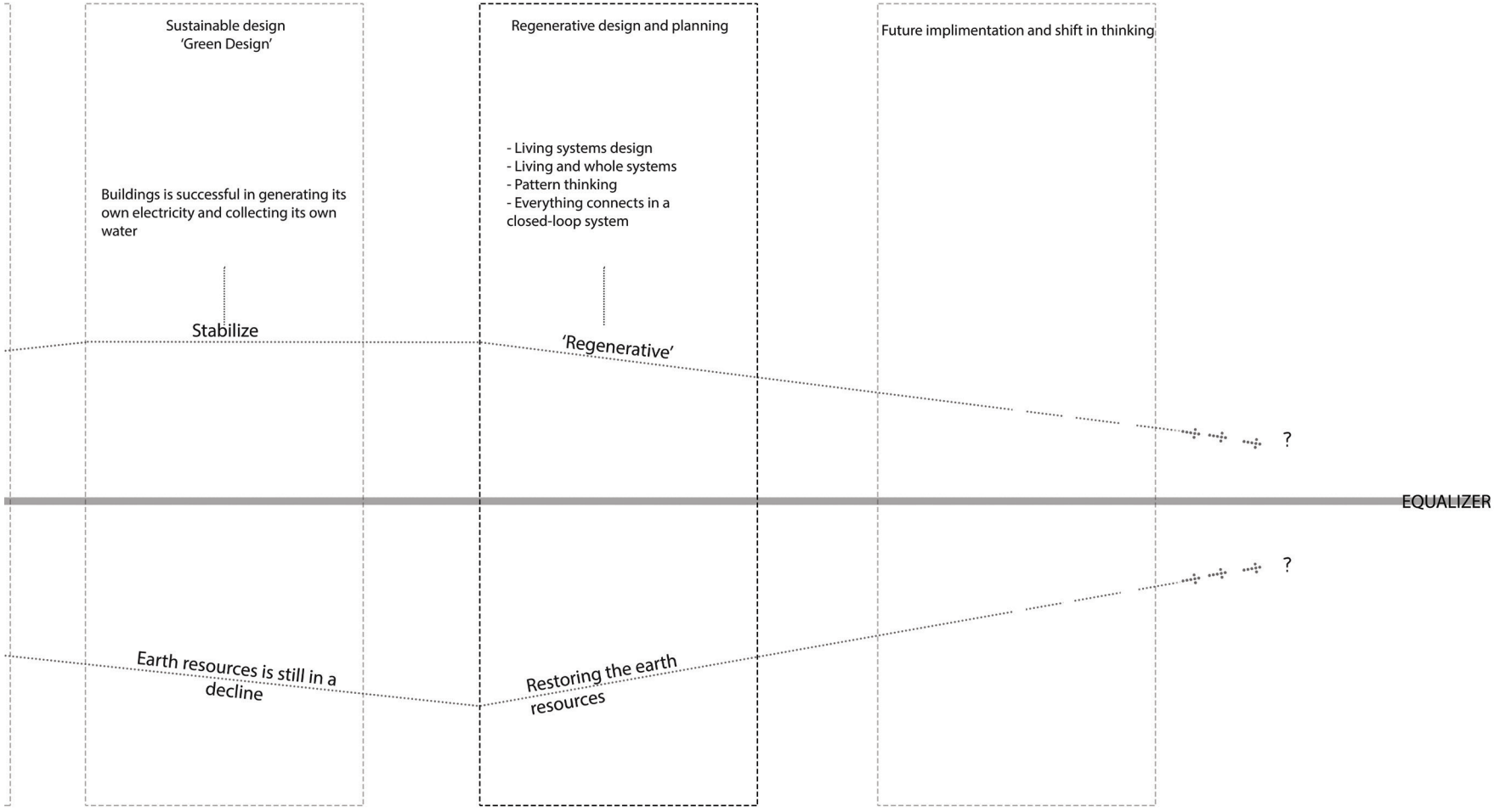


2.3_ The industrial revolution changed the relationship between humans and their environement. (https://taapworld.wikispaces.com/The+Environmental+Impact+of+the+Industrial+Revolution).



2.4_ The Crystal Palace in 1851. Technological wonder of the world. After it had been converted into a giant hothouse and imperial cultural museum, it betrayed the contemporary tendancy to make nature and culture jointly into indoors affairs. (http://www.ispaopp2013conference.pt/p-about-porto)





2.5_ Timeline describing the progression of the history of architecture towards an ecological paradigm. (http://www.historyworld.net/wrldhis/PlainTextHistories.asp?ParagraphID=dor) adapted by (Author, 2015)

2.3 / PROBLEMS WITH SUSTAINABILITY

Many initiatives have been launched regarding the development of sustainable buildings and construction. Unfortunately, the contribution of these initiatives to the global sustainability project is insufficient in scope and pace; falling short of a pivotal contribution to a more sustainable world (Du Plessis, 2006: 2). If sustainable design achieves carbon neutrality[5], then the factors which remain to sustain life are water quality, air quality, food production, biodiversity, etc. The list can keep on growing, but, the fact of the matter is, none of these factors can individually sustain life.

There is an increasing awareness that buildings cannot be designed without taking their environmental impact into consideration. A sustainable building can be defined in the broader context as one that has a minimum impact on the natural- and built environment. The building itself has a minimum impact on the immediate surroundings and regional setting (John, et al, 2004: 320).

But, something is amiss in how we understand the word 'sustainability'. Gladwin (Cole, 2012: 5) explains that the human mind has formed fixed opinions over time, favoring simplicity, certainty and immediate notions. The concept of adaptive learning, which allows thinking towards sustainability, is consciously obstructed. These patterns of thinking render the human mind incapable of appreciating, let alone beginning to address, the challenges of sustainability. Green building assessment tools emerged from the necessity of overcoming this mind-set (Cole, 2012: 5). The foundation stones for green buildings, which ultimately led to the development of the assessment tools such as LEED and BREEAM (Du Plessis, 2006: 3), are listed as follows:

1. The return to the use of natural building materials and the effective use of resources, like recycling.

2. Buildings should aim to be self-sufficient, for example, by gathering solar energy, collecting filtered water, waste management; all to be achieved with appropriate technologies.

3. The integration of the building with the site condition.

4. An ultimate improvement in the air quality of a building.

An advance in the management of natural resources and of building stock will lead to a definite improvement in environmental quality, accompanied by the reduction of scarce resource use and energy consumption (John, et al, 2004: 320). According to Cole (2012: 3), the characteristics of green building assessment tools can be defined as follows:

[5] Carbon neutrality is a term used to describe the action of organizations, businesses and individuals taking action to remove as much carbon dioxide from the atmosphere as each put in to it. The overall goal of carbon neutrality is to achieve a zero carbon footprint (www.webopedia.com/TERM/C/carbon_neutral.html)

1. Individual performance of certain components of the building is evaluated to a relative standard, which is either implicit or explicit, but is not considering the absolute consequence on human and natural systems.

The critique is that components should not be evaluated individually, but rather as a complete system; every component should be identified as part of an interconnected system.

2. The benchmark of the assessments is technically framed and based on metrics that are quantifiable, measurable and comparable. It is assumed that it offers an accurate measure to understanding of the overall green building performance.

Systems in nature cannot be compared or measured, thus the benchmark should rather be the performance of nature. A benchmark that is technically framed is limited.

3. The success ascribed to buildings in their Green Star rating is measured through simple addition of the weighted scores obtained in individual performance issues.

Weighted scores limit the potential of nature, and do not allow for a full understanding of natural systems.

4. Maintaining the health of natural systems is implied in the performance criteria, however, it is not emphasized or clearly communicated in the conceptual base and structure of the assessment tools.

Incorporating natural systems should be the main focus of.

5. The assessment tools are framed by a linear approach towards the conservation of resources, which fails to resolve the cyclical process of resources.

The natural cycle of resources should be adapted; namely, a closed loop were no waste is generated.

Since the establishment of green building assessment tools the number of registered LEED projects has increased dramatically and solid environmental gains have been recorded (Cole, 2012: 2). However, despite this result, there is still not any significant progress towards the cessation of global warming. This is perhaps due to the fact that sustainable design or “Green” architecture at present is more focused on doing “less harm” than anything else. This is simply not sufficient for our development of an ecologically sustainable future (Cole, 2012: 3). Sustainable design is a constantly developing concept, which has resulted in a number of “Green” building iterations. Leading “Green” practitioners are searching for answers and pushing the boundaries of current assessment methods. They are emphasizing an eco-efficiency approach (Du Plessis, 2006: 2).

2.4 / CONVENTIONAL THINKING

Worldwide, it is becoming clear that conventional modern architecture and the built environment are not sustainable over the long term. Therefore, changes are being made in building methods and approaches. These aim to use energy and materials more efficiently (John, et al, 2004: 319).

There is an increasing realization that the built environment is a requisite part of the natural world and natural systems (Peres et al, 2015: 40). The way we think about buildings and the built environment must change if we are to engender a significantly positive effect on the natural world. The problem on a global scale is: how can one pare the scale down to an architectural solution?
The construction sector of the built environment holds an important place in the global economy. It also has some of the biggest negative impacts on the environment (Smith et al, 1998: 3). Methods of construction are established in today's textbooks on how buildings work. When we challenge and argue building methods, we argue with 'tried and tested' decisions made over a long period of time. We argue with nameless ancestors, and we will lose the argument (Brand, 1994: 2). The term 'architecture' is always seen in its wider use as 'unchanged deep structures' (Brand, 1994: 2).

Nevertheless, we cannot solve the problem of sustainability by using the same method over and over again. To find a building solution we must first understand how the building functions. We can gain comprehension by looking at Frank Duffy's layered building perspective. Frank Duffy is a leading theorist in the change rate of buildings. He distinguished four independent layers of longevity and of building components in buildings (Brand, 1994: 12):

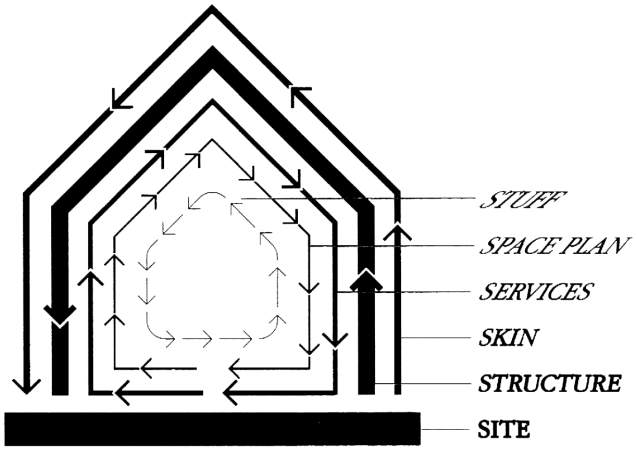
Shell: Structure, which lasts the lifetime of the building.

Service: Cabling, plumbing, air conditioning and moving parts, which are the elevators. It has to be replaced every 15 years or so.

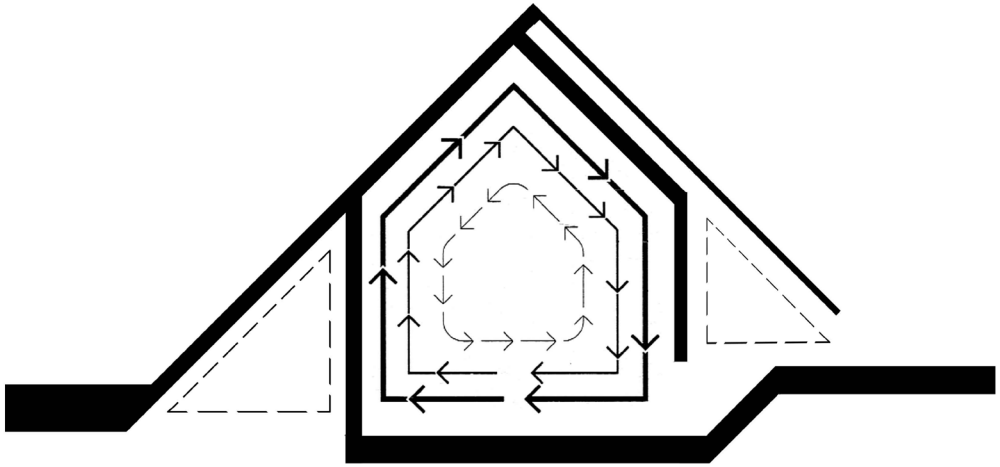
Scenery: The interior layout of the building; partitions, dropped ceilings, etc. The layout can vary in its change, every 5 – 7 years.

Set: The furniture of a building, which can be shifted by the occupants.

Duffy (1994: 17) advises designers to steer away from solving a five-minute problem with a fifty-year solution. He states that these layered approaches work well when it comes to building practice. The most important aspect of a building is the components that make up the shell; called the envelope of a building. The envelope of any building consists of walls, floor and roof. These components protect the interior of a building against



2.6_ Steward Brand depiction of Duffy's building layers into six 'S' (Brand, 1994: 13)



2.7_ Steward Brand depiction of Duffy's building layers adapted to include the site as an integral part of the building layers (Brand, 1994: 13 edited by author, 2015)

external elements, such as, wind, rain, sun, noise and heat. Thus, the living conditions for humans are improved inside a building (John, et al, 2004: 322). The envelope acts as a climate moderator, a role it has performed since the earliest history. It evolved with technology over time, keeping pace with environmental requirements and the continuous changes in social and economic patterns (John, et al, 2004: 322).

Steward Brand expanded Duffy's four 'S' perspective into a six 'S' theory, which includes interior work (Brand, 1994: 13):

Site: The geographical urban setting or location. The site is eternal.

Structure: It consists of the whole envelope of the building; foundation, load bearing walls and roof. It is perilous and expensive to change. Lifespan of less than 60 years.

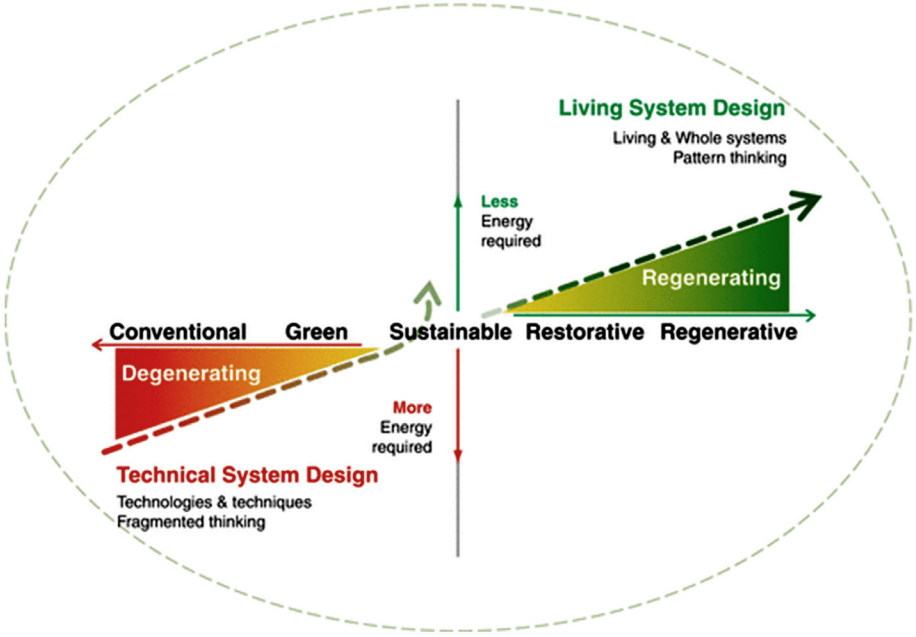
Skin: Exterior surfaces, such as, paint or cladding. This changes every 20 years.

Services: The working systems of a building; wiring, plumbing, HVAC, and moving parts. Buildings are demolished early if their outdated systems are too deeply embedded to replace and can't be accessed easily.

Space plan: The interior layout of a building; walls, ceilings, floors, doors.

Stuff: All interior furniture or accessories that can be changed by the occupant.

It is critical to note that the comprehensive function of a building envelope, the exterior wall in conjunction with the roof and floor, is to moderate solar radiation, temperature extremes, moisture content, dust and wind (John, et al, 2004: 322). The changing architecture of the present and fast pace expansion of cities and industries mean that numerous new designs are available and made possible by the use of new materials and construction techniques. Sadly, some designs are being approved without proper understanding, consideration and assessment of our current environmental status (John, et al, 2004: 322).



2.8_ Framework for sustainability, Contrast of Technical System Design and Living System Design (Mang et al, 2012: 10)

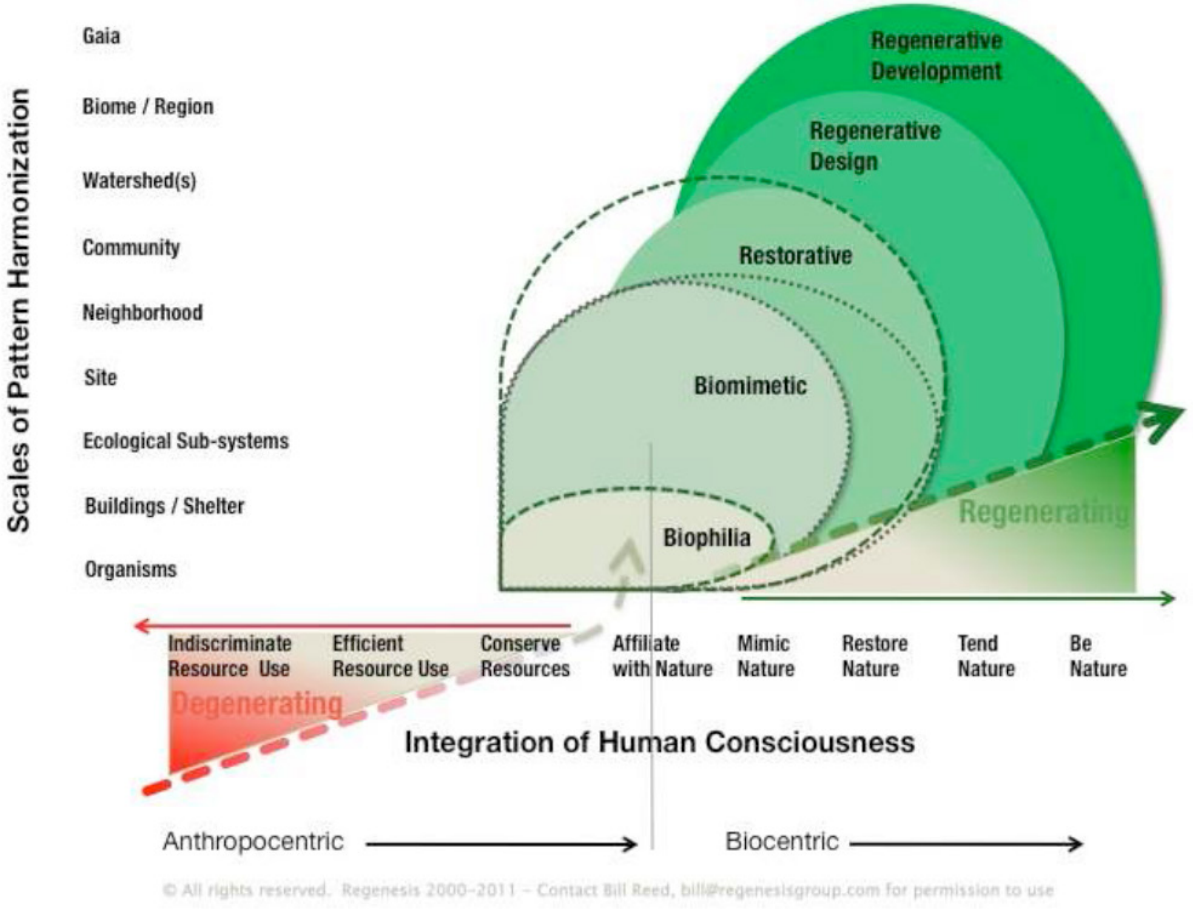
2.5 / CHANGE OF THINKING / Paradigm shift

It is critically important to reach carbon neutrality. This will give us more time to ascertain how we are to sustain life and how to achieve a mutually beneficial relationship between humans and nature. If we try to solve this problem technically we will just end up with a sustainable building.

"To follow the path towards sustainable building solutions is only a slower way to die… we need to turn around."
Bill Reed, 2010, Health schools conference

By looking at technical systems design inversely, we can arrive at living systems design. This refers to observing patterns in nature and discerning how to work with life as a whole living system (Refer to figure 04). To sustain life, we must know what life is. Life is a complete evolving complex of self-sustaining processes and is bound to a closed interconnected system; where everything is linked in some form or another. We need to start taking a systems approach, because everything is connected. Accordingly, we simply cannot focus on problems as individual entities but must rather view them as a whole. Bill Reed (2010, video) describes three aspects of systems, whether they be living or technical: Elements in interrelationships (because life is all about relationships) where every system must have a purpose.

This shifting world view, towards an ecological paradigm,



2.9_ Levels of Ecological Strategies for Sustainability. Regenerative- acknowledges that humans are "nature". In order to create sustained ecological health, humans must evolve a conscious and integral interrelationship where humans and nature are in a mutually beneficial being and becoming relationship.(Mang et al, 2012: 13).

implies that humanity should work with nature to not just reduce negative impacts but also pursue a net positive result by working together as a single interconnected intelligence (Du Plessis, 2006: 2). Meadows' (Cole, 2012: 5) strategic guidance indicates that natural complex systems cannot be controlled, although they can be designed and then re-designed. He also implies that humanity cannot undertake the future with this new world view and have full confidence that there will be no surprises; humanity must learn from these surprises and even profit from them. This approach requires the conventional human mind-set of being experts to be replaced with a belief that we are 'co-learners' with nature. The basis of systems thinking approach is thus the establishment of a network of mutual learning (Cole, 2012: 5).

Humans are an inseparable part of nature, therefore humanity has the ability to adapt and rethink our way of life and development. The notion of living and building in harmony with nature has existed since the time of ancient Greece. It was revived by Vitruvius and revived again by the 19th century romantics. Du Plessis (2006: 3) believes that the idea behind this notion was both pragmatic and nostalgic; a spiritual aesthetic pursuit to reconnect with nature. Pawlyn (2011: 1) describes three shifts that are necessary for humanity to sustain life;

1- Shifting from a linear one-way-flow of managing resources and waste to a closed-loop model were no waste is generated6
2- Shifting from a fossil-fueled economy to a solar economy.
3- Shifting to an increase in resource efficiency

All living things have a constant need for shelter and nutrition. Humanity is destroying both by means of agriculture and building institutions. However, through the adoption of natural processes, there is an opportunity to heal the planet. Architects must view the environment they work in as a whole living organism, which has a purpose. They must identify the complexities within the environment and understand the patterns of life. Architects then have the opportunity to solve a world problem through small, strategic, architectural insurgence (Reed, 2010).

Therefore, if there is to be meaningful change in the 21st Century, there must be a change in the mindset towards the ecological, social and economic systems of the built and natural environment (Peres et al, 2015: 40). This has to start from a different point of departure; one such different point being the support of an ecological world view.

[6] linear 'one-way-flow' and 'closed-loop-system' will be explained in the theory chapter 3